on to misapply the very same word and to use it in the sense of "activity," saying in effect that (by Jacobi's law) the "utility" is a maximum when the reaction of the motor reduces the supply-current to one-half. The diagram intended to represent Hall's experiment on p. 628 is quite wrong. The statement on p. 503 that the velocity of light is greater in metals than in air is incorrect: the refractive index is greater, therefore the velocity less. The author has most wisely abandoned the use of that most misleading of terms, vapour-tension, and substitutes therefor simply pressure. This is well; but the reform must go further, and should have gone further at the hands of so worthy a pupil of the Scottish school of physical precision. A reference to the index shows apparently that the author uses the word "*pressure*" correctly and consistently in the sense of force per unit area. If this were so, it would be excellent. Unfortunately the text of the treatise is not always consistent. On p. 152 the author talks of applying a "pressure" to a lever, where he does not mean so many dynes per square centimetre, but where he means simply a "force,"—a push. Of course this confusion of language is pardonable: it runs riot throughout every Cambridge text-book of mechanics from Todhunter to Garnett. We had hoped better things here. Again on p. 154 comes the following question:—"A nutcracker 6 inches long has a nut in it an inch from the hinge: the hand exerts a pressure of 4 lbs.: what is the stress on the hinge?" Answer: "The stress on the hinge is the weight of 24 lbs." In the first place the word "stress" is wholly misapplied; for a stress is not a force, but a force divided by the area on which it is applied: and in the second the word "pressure" is equally misapplied, because what is meant is that the hand applies a "force" equal to the weight of four pounds. In like manner the author's general precision of language would lead to the expectation that he would not misapply that unhappy word "tension." Referring to the index it appears that he uses the word tension in four different senses. He speaks of "surface-tension" of a liquid: which is excusable if the words are connected by an indissoluble hyphen. He speaks of voltaic cells being coupled in "tension," where he means united in series. He speaks (p. 522) of atmospheric pressure in an electrified soap-bubble being resisted by "an electric self-repulsion or *tension* over the surface" (as if self-repulsion were a pulling instead of a pushing force!); and lastly, he speaks of the "tension" of a string (p. 142) when he means the pull, not the stress of so many dynes per square centimetre. He is no worse, however, than the majority of writers on the subject. The average Cambridge text-book teems with similar instances, where problem after problem is set to "find the tension in a rope," without the necessary data as to area of cross-section in the rope being given. There is one book on physics, now happily almost extinct, in which the word tension is used in eight different significations!

Lastly, we must congratulate Mr. Daniell on having embodied the latest results of contemporary research in his work. The ordinary text-book is not seldom ten or fifteen years behind in its data, in some cases more. Here, however, we find, absorbed into the fibre of the book, the most recent matter, such as the researches of Lord Rayleigh on the unit of resistance, of Quincke and of Worthington on capillary phenomena, of Guébhard on electro-chemical figures, of Crookes on radiation and "radiant matter," of O. E. Meyer on viscosity, of A. M. Mayer on the analysis of sounds, of Rosenthal on animal heat, of Vierordt and of Chauveau on blood-pressure, of Wintrich on the use of resonators in auscultation, and of Abney and of Langley on dark radiation. A text-book so furnished forth is doubly welcome. S. P. T.

RECENT CHEMISTRY

Experimental Proofs of Chemical Theory for Beginners. By Prof. Ramsay. (London: Macmillan, 1884.)

The Discovery of the Periodic Law, and on Relations among the Atomic Weights. By John A. R. Newlands. (London: Spon, 1884.)

Chemical Analysis as applied to the Examination of Pharmaceutical Chemicals. By Messrs. Hoffmann and Power. Third Edition. (London: Churchill, 1884.)

Chemical Analysis, for Schools and Science Classes. By A. H. Scott-White. (London: Laurie, 1884.)

Facts Around Us. By C. Lloyd Morgan. (London: Stanford, 1884.)

Science of Food. A Text-book specially adapted for those who are preparing for the Government Examinations in Domestic Economy. By L. M. C. (London: George Bell and Sons, 1884.)

An Outline of Qualitative Analysis for Beginners. By J. T. Stoddard. (Massachusetts, 1883.)

THERE is not the least doubt that in English laboratories theory does not occupy a prominent position. Prof. Ramsay is to be complimented on this very small book, which is certainly a valuable attempt to put chemical theory on a practical basis. It consists of a series of exercises on the measurement of temperature, pressure, and weight in connection with gases, &c., and contains very valuable directions and instructions in the manner of reading thermometers and barometers, and representing changes by curves, and also in the graduation of thermometers and other instruments in common use in the chemical laboratory, a work which should not be relegated entirely to a physical laboratory. The work is divided into twelve chapters, in all of which we have very excellent practical exercises on what is commonly known as chemical theories, that is, the sensity of gases, the law of Gay Lussac and Avogadro, on quantivalence, specific heat, and the equivalents of metals, and a short chapter summarising Newlands' work on the periodic law of the elements. We can strongly commend this little book to all students in chemical laboratories.

Mr. Newland's little book, as the author says in his preface, contains an exact reprint of all the papers on relations among the atomic weights and on the periodic law written by himself and printed in the *Chemical News* during the last twenty years. In its present form it is a desirable addition to our literature, and should bring Mr. Newlands' very valuable work into its proper position.

Messrs. Hoffmann and Power's very elegant work is evidently not adapted to an ordinary chemical laboratory. As the authors state, it has been prepared for the pharmacist and dispensing practitioner of medicine, for the purpose of enabling him to test chemicals and drugs used in pharmacy. The arrangement of the work is

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therefore such as to suit the practical pharmacist rather than the analytical chemist. The substances are described under their several Latin synonyms, in addition to the French, German, English, and Spanish names. We find that each preparation is described as to physical and chemical properties, and then follows a very elaborate examination for the presence of impurities, in addition to methods of quantitative determination of the principal constituents. It should be a very useful addition to the pharmaceutical laboratory.

Mr. Scott-White's volume is one of the usual little books of chemical analysis tables. There seems to be nothing very remarkable about it, excepting the variety of types in which the formulæ are printed. The book, which is intended as a text-book for the various examinations of the University of London, Oxford and Cambridge Senior Locals, and the Kensington examinations, seems well adapted for its purpose. It contains a table of solubilities of common inorganic salts, which is a thing students rarely make use of; and an appendix of requirements in examinations, detailing apparatus, chemicals, &c., necessary for most of the elementary examinations in chemistry.

With all our science classes and the very general spread of scientific education throughout the country, it is still a sad fact that the great mass of the public and even of the middle-class educated public are wofully ignorant on common things. Even now it is somewhat out of place to talk in a drawing-room about oxygen: as to the mention of phosphorus or selenium, or metals like platinum or iridium, it is still more out of place. A great deal of this ignorance—ignorance possibly occasioned by dread—is doubtless caused by the very scientific science books that are in common use. We are almost entirely without books on general science that are sufficiently simple, and at the same time accurate, to convey a general but correct notion of ordinary substances, or to interest the ordinary reader in all these things around us. Why should not the properties of oxygen or phosphorus be quite as interesting reading as some of the three-volume novels? Mr. Lloyd Morgan in his very small book has evidently intended to supply to some extent this want by describing—not in simplest language, it might have been simpler—a few very common chemical and physical facts. It does not appear exactly from the preface for what class of readers it is intended, but it can scarcely fail to be useful if not interesting to any lay readers. It commences with the chemistry of a candle flame, and in that way passes on to the similar actions taking place in animals and plants, where of course carbonic acid comes into play, and we are led through carbonic acid to wood, coal, and diamonds, to the atmosphere, where the physical part comes in, the pressure of the atmosphere, the thermometer, and the idea of elements, compounds, and mixtures. Passing on to water, we have the proof of the composition of water, physical properties of water, which leads directly on to the phenomena of heat. Although only consisting of about 150 small pages, we are led up at the end to some chemical reactions, and an appendix on molecules. The whole book is arranged for experimental purposes, although the methods of performing some of the experiments are not given. It has been probably assumed that the experimenter should have conveniences supplied. The appendix on arithmetical questions seems scarcely required in such a work, but, excepting this, it is certainly a step in the right direction to bring a knowledge of common things into a simple and understandable shape.

"L. M. C.'s" text-book is a sort of chemical, physiological, and biological book, and is divided under the following heads:—Food, its composition and nutritive value; its functions; and its preparation and treatment. It is evidently got up for the purpose of preparing for the examinations, as it says in the introduction that a grant of 4*s.* will be given for a pass, and that payment upon the results of examinations of school children are made to managers. In spite of this a considerable amount of useful information may be obtained from it, although that information is not conveyed in the best possible style. The descriptions of substances like bread, for instance, are not by any means exhaustive. Under animal food or flesh, it is stated that "animal food is composed of the same materials as vegetable; it is formed of the same elements and presents the same approximate principles, and contains water and mineral matters of the same kind as plants." This is not very instructive. The section on food and its selection will be useful, but the main object of the book is evidently to prepare for the examinations on this subject.

If the spread of chemical teaching may be measured by the number of small books on qualitative analysis, it certainly has a great number of disciples. There is nothing very extraordinary in Mr. Stoddard's book, unless it be the importance that is given to the atomicity marks attached to the signs of the elements. We find that iron is described as $\mathrm{Fe}^{\mathrm{ii}}$ and also $\mathrm{Fe}^{\mathrm{iiii}}$, whilst chromium is only put down as $\mathrm{Cr}^{\mathrm{iiii}}$. Nickel and cobalt are both marked as dyad and tetrad. Only the so-called ordinary elements and acids are treated of.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

Reply to Mr. Grubb's Criticisms on the Equatorial Coudé of the Paris Observatory

In continuation of my first letter I now wish, in my turn, to criticise Mr. Grubb's instrument, and to show that in all respects it bristles with inconveniences. I discuss it as it is presented and explained by Mr. Grubb, and I wish to examine it successively—

(1) From the optical point of view.
(2) From the point of view of the mechanism employed.
(3) From the point of view of its application to astronomy.

(1) The optical point of view. The system adopted by Mr. Grubb is much inferior to that generally used in ordinary equatorials. The dialytic telescope only gives images free from colour for the point which lies in the axis of the object-glass. For all other points images present themselves under the form of spectra which are longer as they are further from the axis. This arrangement necessitates that the three lenses must be very exactly centred, which can be done with the ordinary achromatic object-glass where the two lenses are in contact in the same cell. It is with very great difficulty that this can be done in a dialytic telescope. While admitting, however, that it can have an optical axis common for all the lenses of which it is composed, this centering becomes very difficult when the images are broken by a plane mirror, the

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